

A New Hawaiian Percoid Fish, *Suttonia lineata*, with a Discussion of Its Relationships and a Definition of the Family Grammistidae¹

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THE IMMEDIATE RELATIONSHIPS of the fish described here appear clear cut. However, the systematic position of the "pseudogrammid" group of genera to which it belongs is a matter of considerable controversy; the greater part of the present paper will be devoted to this subject.

The "pseudogrammid" genera (Table 1) are made up of a small number of serranid-like fishes which for the moment may be sufficiently defined as having a single enlarged (though frequently concealed) spine at the upper end of the preopercular border (Fig. 2*a*), and an incomplete or interrupted lateral line. Four genera are included in the group; they may be distinguished as follows:

- | | | |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| 1 | Preopercular spine directed downward (this character not recorded for <i>Rhegma gregoryi</i> or <i>Pseudogramma guineensis</i>) | 2 |
| | Preopercular spine directed somewhat upward. No large lateral line pores between the eyes; in the adult <i>Aporops bilinearis</i> there is a frilled collar behind the tube of the anterior nostril, and just ahead of the preopercular spine is a small patch of glandular tissue that may bear black, hairlike processes..... | Aporops |
| 2(1) | No tentacle over the eye..... | 3 |
| | A single, fleshy tentacle over each eye | Rhegma |

- 3(2) Preopercular spine broad-based and triangular (Fig. 2a).....
.....Pseudogramma
Preopercular spine elongate and downwardly curved (Fig. 1).....
.....Suttonia

Aporops appears to be rather distinct from the other three genera. Whether *Rhegma* and *Suttonia* should be considered as more than subgenera of *Pseudogramma* is open to question.

Genus SUTTONIA Smith, 1953

TYPE SPECIES: *Suttonia suttoni* Smith, 1953 (East Africa). The only other species attributed to the genus is the one described below.

Suttonia was differentiated by Smith (1953: 549) from *Pseudogramma* and *Aporops* as follows: "Scales all cycloid. Preopercular spine large, sabre shaped and trough like. Nasal tube longer than interorbital width. Interorbital mostly naked. Palatines subparallel. A single lateral line." Aside from the fact that in the Hawaiian specimens the palatines are not particularly subparallel, there seems to be little to add or subtract from Smith's diagnosis.

Suttonia lineata new species
Fig. 1 and Table 1

HOLOTYPE: USNM 177950, 78 mm. in standard length, collected with a commercial fish poison off the Waianae coast of Oahu, Feb. 3, 1958, by Gosline, Takata, *et al.* in 10–12 fathoms of water.

PARATYPES: UH 2460, 5 specs., 36-72 mm., with the same data as the holotype.

There are VI dorsal spines in the holotype, VII in all five paratypes. In the larger specimens

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TABLE 1
CERTAIN COUNTS IN "PSEUDOGRAMMIDS"

SPECIES	SOURCE	DORSAL	ANAL	PECTORAL	SCALES	GILL RAKERS ¹
<i>Aporops</i>						
<i>bilinearis</i>	Schultz, 1953	VII, 23-24	III, 19-21	16-18	ca 59-71	16-18
<i>alfreei</i>	Smith, 1953	VI-VII, 23-24	III, 21	15	80	×
<i>japonicus</i>	Kamohara, 1957	VII, 21	III, 16	×	ca 60	13
<i>Rbegma</i>						
<i>thaumasium</i>	Kanazawa, 1952	VII-VIII, 20-24	III, 16-19	16-18	47-52	14-17
<i>gregoryi</i>	Breder, 1927	VII, 15	III, 12	×	48	×
<i>bermudensis</i>	Kanazawa, 1952	VII-VIII, 19	III, 16	14	40-42	15
<i>Pseudogramma</i>						
<i>polyacantha</i>	Schultz, 1953	VII-VIII, 15-18	III, 15-18	17-18	ca 50-54	17-18
<i>guineensis</i>	Norman, 1935	VII, 20	III, 16-17	×	48?	×
<i>brederi</i>	Longley and Hildebrand, 1940	VII, 21	III, 17	14	50	×
<i>Suttonia</i>						
<i>suttoni</i>	Smith, 1953	VII, 23-24	III, 19	16	60	15
<i>lineata</i>						
Holotype.....		VI, -	III, -	16	64	—
Paratypes.....		VII, 23-24	III, 20-22	16	58-61	16

¹ Including rudiments.

the soft dorsal and anal rays are not only covered with skin and scales, but the basal portion of the rays becomes embedded in a heavy layer of fatty tissue. As a result the counts for these fins are based on only three paratypes, one in which the fins have been dissected (given first), and the two smallest: soft dorsal rays, 23, 23, 24; soft anal rays, 20, 21, 22. In the paratype dissected for the fin counts there are 5 gill raker rudiments above, 1 at the angle, and 10 rakers and rudiments below. Other counts are given in Table 1.

There seems no reason to give a long description of *Suttonia lineata*, for most of Smith's (1953) account of *S. suttoni* applies equally well to *S. lineata*. In one paratype there are two short, muscular caeca on either side of the pyloric end of the stomach. The pore configuration of the head is that of *Pseudogramma* rather than *Aporops*, i.e., there are two slitlike pores in the interorbital. There is also an especially large pore, larger than in either *Pseudogramma* or *Aporops*, at the very base of the free preopercular border. The preopercular spine is elongate, downwardly curved, and has a deep, sharply demarcated, central gutter filled with glandular

tissue. There are no externally visible spines on the operculum, and the opercle itself has almost exactly the shape of that in *Pseudogramma* (Fig. 5). The teeth are about as described in *Suttonia suttoni* and almost exactly duplicate the dentition of *Pseudogramma polyacantha*. The nasal organ is also like that of *Pseudogramma* (Fig. 2b). As Smith (1953) has already noted, the scales on the top of the head stop short of the interorbital and the interorbital pores in *Suttonia*; in *Pseudogramma* the squamation extends forward nearly to the front borders of the eyes and surrounds the interorbital pores.

The most obvious differences between *Suttonia suttoni* and *S. lineata* lie in coloration. A color description of the latter species made after the specimens had been a week in formaldehyde is as follows: "Body reddish gray; dorsal, anal and caudal with a narrow white border. Lower half of head (below a rather abrupt transition zone running through the lower border of eye), pectorals and pelvics reddish. Upper half of head darker, except for a prominent light red mid-dorsal band running from the dorsal origin to the tip of snout, this band most prominent forward." When first taken, the specimens had an



FIG. 1. *Suttonia lineata*. Paratype, 72 mm. in standard length.

essentially similar coloration. In alcohol, the smallest of the paratypes show a certain amount of reticulation on the lower portion of the head. Unlike *S. suttoni*, *S. lineata* has no dark opercular spot and no lines along the sides.

Aside from the characters noted in the last sentence, *S. lineata* seems to differ from the description and figure of *S. suttoni* given by Smith (1953) principally in the lack of externally visible opercular spines. The two forms are obviously close; they seem to differ to about the same degree as most Hawaiian and East African counterparts do.

Lineata (L.): lined, for the prominent mid-dorsal stripe on the head.

"PSEUDOGRAMMID" RELATIONSHIPS

Though there is little doubt about the close interrelationship of the genera assigned to the "pseudogrammid" group—*Aporops*, *Rhegma*, *Pseudogramma*, and *Suttonia*—there is considerable disagreement about the family to which these genera should be assigned (see Table 2). Regan and Norman have included them in the Serranidae; Schultz placed them in the Pseudochromidae; and Smith erected a separate family for them.

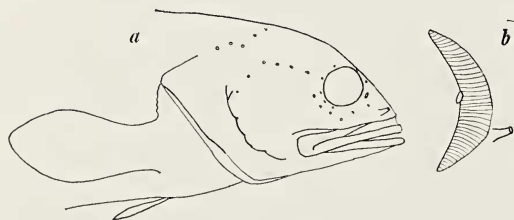


FIG. 2. *Pseudogramma polyacanthus*. a, Lateral view of head; b, diagram of right nasal organ, with covering tissues removed but with the position of the nostrils indicated for orientation.

In an attempt to resolve the problem of "pseudogrammid" relationships, partial or complete skeletons have been prepared of the typical serranid *Epinephelus quernus* (from Hawaii), of *Pseudogramma polyacanthus* (from Hawaii), *Plesiops corallicola* (from the Marshalls; see Inger, 1955: 266), and *Pseudochromis tapeinosoma* (from the Gilberts). Certain aspects of the soft anatomy of these species and of *Epinephelus hexagonatus* (from the Phoenix Islands), *Aporops bilinearis* (from Tahiti), *Suttonia lineata* (paratypes), and of *Grammistes sexlineatus* (from the Line Islands) have been examined. When generic names are used alone in this paper, they refer to the above species.

Soft Anatomy. The only internal soft structure that has hitherto been used in the classification of the "pseudogrammid" fishes is the presence of two heavy-walled pyloric caeca (Smith, 1953: 548, fig. 2). In *Epinephelus* pyloric caeca are relatively numerous (cf. Suyehiro, 1942: 161, fig. 112), and in *Plesiops* and *Pseudochromis* they are completely lacking.

A second feature that seems at least equally significant is the structure of the nasal rosette. In *Epinephelus*, *Pseudochromis*, and *Plesiops* (Fig. 3a) the rosette is small. In *Pseudogramma* (Fig. 2b) the nasal epithelium is extended both upward below the nasal bone and downward below the lacrimal.

In view of this difference between nasal organs, the brains in specimens of *Epinephelus* and *Pseudogramma* were uncovered dorsally. However, no conspicuous differences were seen.

Attempts to investigate the nature of the air bladder were unsuccessful.

In *Aporops*, *Pseudogramma*, and *Suttonia* there is an area of presumably glandular tissue just ahead of the preopercular spine. In *Aporops* this area may be discerned externally, but in the other two genera it is concealed by the skin and scales.

Cranium. The crania of *Epinephelus*, *Pseudogramma* (Fig. 4), *Plesiops*, and *Pseudochromis* differ very little from one another. In *Epinephelus* there is no conspicuous otic bulla as there is in the other three, and the supra-occipital has a well-marked crest. *Pseudogramma* has a median opening to the sensory canal system between the frontals (Fig. 4a), but this is

lacking from the closely related *Aporops* as well as from the other three genera.

Nasal and Circumorbital Bones. In *Epinephelus*, *Plesiops* (Fig. 3*a*), and *Pseudochromis* the nasal bone is merely a weakly S-shaped tube bearing the front of the supraorbital lateral line. In *Pseudogramma* (Fig. 3*b*) the S-shaped tube is present but bears a flange that extends laterally over the upper end of the enlarged nasal organ.

In *Epinephelus* the first circumorbital (pre-orbital) is considerably expanded dorsoventrally; its upper surface articulates with the bottom edge of the lateral wing of the prefrontal, and its posterior edge is suturally joined to the small second element of the circumorbital series. It is the relatively narrow (dorsoventrally) third element that provides the subocular shelf. In *Pseudogramma* (Fig. 3*b*), *Plesiops* (Fig. 3*a*), and *Pseudochromis* the circumorbital series are similar though the preorbital covers relatively less of the surface of the head.

Jaws. The jaws and jaw teeth in *Epinephelus*, *Pseudogramma*, and *Plesiops* are similar. The gape is wide and the maxillary extends behind the eye; the pedicel of the premaxillary is shorter than the toothed portion; the maxillary extends well beyond the premaxillary maxillary and has a splintlike supramaxillary on its straight upper border (Figs. 3*a*, *b*); many of the teeth are depressible; and the teeth in the lower jaw extend well behind those of the upper and are

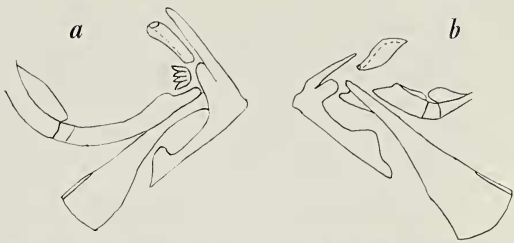


FIG. 3. First three circumorbital bones, nasals, premaxillaries, maxillaries, and supramaxillaries; teeth not shown. *a*, *Plesiops*, right side, with the nasal organ indicated; *b*, *Pseudogramma*, left side.

in two or more rows throughout. In *Pseudochromis* the jaws are shorter and the teeth are all rigid; the premaxillary pedicel is at least as high as the toothed portion; the maxillary curves down around the end of the premaxillary and lacks a supramaxillary; and the teeth in the lower jaw are in a single row laterally. The teeth on the vomer, palatines, and pharyngeals of *Pseudochromis* are all rigid, as compared to the partly depressible teeth on these bones in the other three genera.

Suspensorium. The chief difference in the suspensoria of the four genera studied seems to be that the palatine of *Pseudochromis* is loosely articulated (apparently by ligament) to the rest of the structure, whereas in the other three it is rigidly united by suture to the ectopterygoid and mesopterygoid (Fig. 5).

TABLE 2
TAXONOMIC TREATMENT OF CERTAIN PERCOID GROUPS BY VARIOUS AUTHORS

SMITH, 1949, 1953 1954 <i>a</i> , 1954 <i>b</i>	WEBER and DE BEAUFORT, 1929, 1931	REGAN, 1913	NORMAN, 1957	SCHULTZ, 1953
Pseudogrammidae.....	} to Serranidae	} to Serranidae	} to Serranidae	} Pseudochromidae
Pseudochromidae				
Pseudochrominae...				
Pseudoplesiopsinae	Pseudoplesiopidae	Pseudoplesiopidae	} Plesiopidae	
Plesiopidae.....	Plesiopidae	} Plesiopidae		
Acanthoclinidae.....	Acanthoclinidae		Acanthoclinidae	
Anisochromidae.....	—	—	—	—

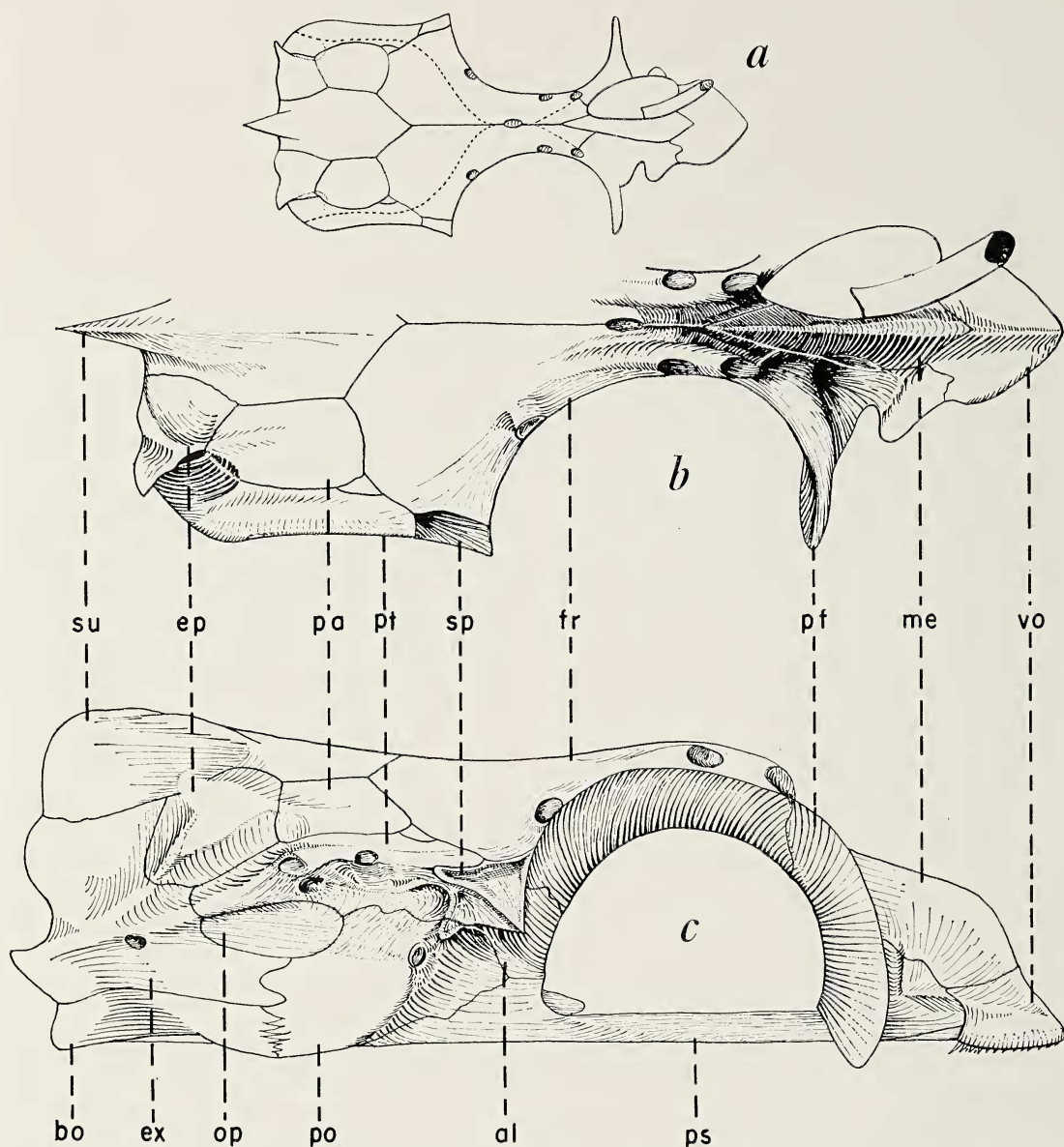


FIG. 4. *Pseudogramma*. *a* and *b*, Top views of the skull, with the left nasal bone in position, *a* showing the inner borders of the infraosseous portion of the supraorbital lateral line canals by dashes; *c*, side view of skull. al, Alisphenoid; bo, basioccipital; ep, epiotic; ex, exoccipital; fr, frontal; me, mesethmoid; op, opisthotic; pa, parietal; pf, prefrontal; po, prootic; ps, parasphenoid; pt, pterotic; sp, sphenotic; su, supraoccipital; vo, vomer.

Opercular Bones. The preopercle of *Epinephelus* is serrate. In *Pseudogramma* the edge is membranous except for the single enlarged spine (Fig. 5). In *Pseudochromis* the entire edge is membranous. In *Plesiops* the preopercle has a double border reminiscent of that appearing ex-

ternally in some of the apogonids, but neither of these borders is serrate.

In *Epinephelus* the opercle has three superficially visible spines. In *Pseudogramma* (Fig. 5) these spines have become rudimentary and are concealed, but they can still be made out

when the opercle is cleaned. The opercle of *Plesiops* ends in a frayed membrane and that of *Pseudochromis* is rounded posteriorly.

Hyoid Arch. There are seven branchiostegal rays in *Epinephelus*, *Pseudogramma* (Fig. 6), *Aporops*, and *Suttonia*; six in *Plesiops* and *Pseudochromis*. The branchiostegal membranes are broadly attached to the isthmus in *Pseudochromis*, attached far forward to one another but more or less free from the isthmus in the other genera. In *Plesiops* alone the third branchiostegal ray is considerably larger than those before and behind it.

Gill Arches. In all four genera skeletonized there is a pseudobranch, and the cleft behind the fourth gill arch is considerably restricted. In all, there is one pair of dentigerous lower and three pairs of toothed upper pharyngeals. In *Epinephelus* and *Pseudochromis* the gill rakers are fairly normal; the gill rakers of *Pseudogramma* and *Plesiops*, however, are in the form of flat plates at the ends of the arch with spiny knobs toward the central portion.

Pectoral Girdle. The pectoral girdle in all

four genera is similar (Fig. 7) despite the fact that externally *Pseudogramma* appears to have a lobate pectoral base. In all, a long extension of the coracoid runs downward and forward to meet the cleithrum. There are two postcleithra. The forward tip of the pelvic girdles articulate with pads on the inner surfaces of the cleithra. One and a half actinosts join the coracoid and two and a half meet the scapula, though the relationship is more nearly one and three in *Pseudochromis*. The most notable difference would appear to be that there is a curious downwardly projecting hook (or, viewed conversely, an embayment) in the outer surface of the cleithrum of *Plesiops* below.

Pelvic Girdle. The pelvic girdle in all four genera consists primarily of struts between the pelvic fins and the cleithra (Fig. 7). Those of *Pseudogramma* are surprisingly strong and are longer than the pelvic fins themselves.

Vertebral Column. The number of vertebrae for several species of *Epinephelus* given by Boulenger (1895: 115) is 24. The vertebrae in *Pseudogramma* (including the terminal half-

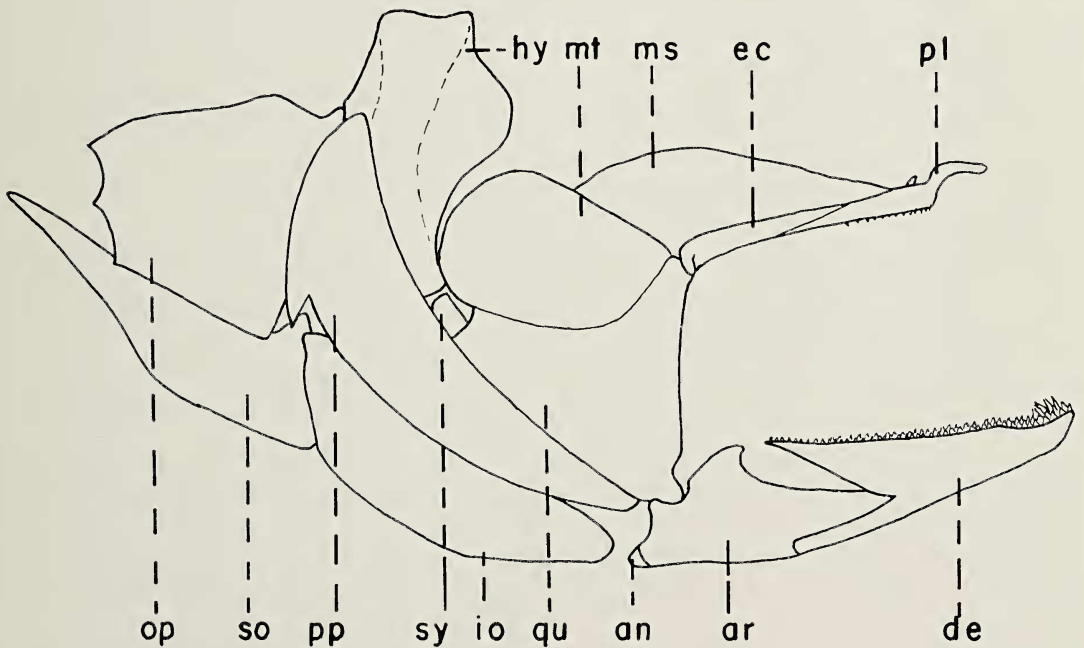


FIG. 5. Right suspensorium and lower jaw of *Pseudogramma*, external view. an, Angular; ar, articular; de, dentary; ec, ectopterygoid; hy, hyomandibular; io, interopercle; ms, mesopterygoid; mt, metapterygoid; or, opercle; pl, palatine; pp, preopercle; qu, quadrato; so, subopercle; sy, symplectic.

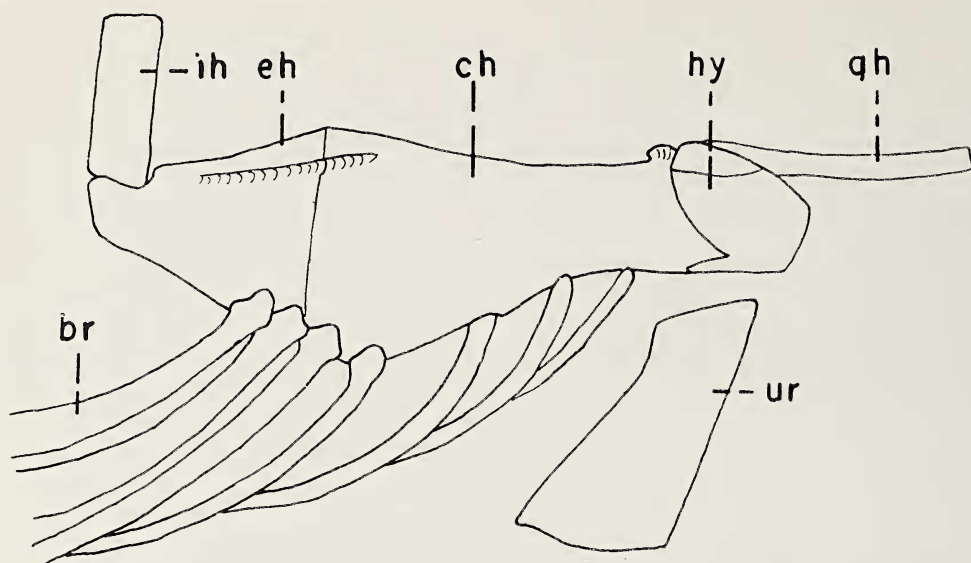


FIG. 6. Right half of hyoid apparatus of *Pseudogramma*, external view with the urohyal dislocated. br, Branchiostegal ray; ce, ceratohyal; eh, epihyal; gl, glossohyal; hy, hypohyal; ih, interhyal; ur, urohyal.

vertebra) number 26, in *Plesiops* 25, and in *Pseudochromis* 26. The first interneural in *Pseudogramma*, *Plesiops*, and *Pseudochromis* extends between the second and third neural arches; *Epinephelus* was not examined for this character.

In *Epinephelus* and *Pseudogramma* the second interhaemal is very strong and runs up to wedge into the posterior face of a haemal arch. In *Plesiops* and, especially, *Pseudochromis*, the second interhaemal is considerably weaker.

Caudal Skeleton. The caudal skeleton of all four genera appears to be built on the same plan (Fig. 8), though there is considerable minor variation, especially in the amount of fusion. Thus there may be two or three epurals and three to five hypurals.

Summary of Internal Differences. Though the internal, especially the osteological, differences between *Epinephelus*, *Pseudogramma*, *Plesiops*, and *Pseudochromis* are slight, they are not entirely negligible. Thus each of the three serranid offshoots stands apart in one fashion or another.

Pseudogramma differs from the other genera in the enlarged nasal organ, the preopercular spine with its associated glandular area, and in having two pyloric caecae.

Plesiops appears hardest to define on the basis of internal features. Perhaps the hook on the anterior face of the cleithrum and the double border to the preopercle are the most salient.

Pseudochromis differs immediately from the others in the mouth parts. The teeth are rigid; the maxillary bends around the premaxillary and lacks a supramaxillary; the premaxillary pedicels are elongate; and the palatines are movably articulated with the remainder of the suspensorium.

External Features. With one exception the external features of the fishes investigated will not be treated on a genus-to-genus basis as they have been noted by every ichthyologist who has worked with these groups. However, some of them will be taken up in the discussion of relationships in the next section.

The exception concerns the number of branched caudal rays. The perciform fishes are often stated to have 15 or fewer branched caudal rays. In *Epinephelus* the usual 15 were counted in 3 specimens. However, 16 are present in the one specimen available of *Grammistes*. The stained specimen of *Pseudogramma* has 17, as does that of *Pseudochromis*. In the 5 available specimens of *Plesiops*, one has 15, one 16, and three 17.

TAXONOMIC TREATMENT OF THE
"PSEUDOGRAMMIDS"

The above review has indicated that there is little basic osteological difference between the serranids, "pseudogrammids," and "pseudochromids." Nevertheless there seems to be one group, traditionally included in the Serranidae, that seems to be far more closely related to the "pseudogrammids" than either *Epinephelus* or the "pseudochromids." This is the "Grammistinae" containing the genera *Rypticus*, *Grammistes*, *Pogonoperca*, and *Grammistops* Schultz, 1953 (which equals *Tulelepis* Smith, 1954). Indeed, upon analysis of the 14 characters listed in Table 3, the "pseudogrammids" fall with the

"pseudochromids" rather than with the "Grammistinae" only in the lateral line and scale structure.

If the "Grammistinae" is enlarged to include the "pseudogrammids," the old distinction of this "subfamily" from the other serranids by the flap connecting the upper portion of the gill cover to the body can be retained, for this feature applies also to the "pseudogrammids." The two groups combined may be defined as follows (though it should be noted that the included genus *Pogonoperca* has not been examined):

Whole upper border of opercle attached to the body by a flap of skin. Nasal organ dorsoventrally elongate, made up of a number of

TABLE 3
COMPARISON BETWEEN "GRAMMISTINAE," "PSEUDOGRAMMIDS," AND "PSEUDOCHROMIDS"

CHARACTER	"GRAMMISTINAE"	"PSEUDOGRAMMIDS"	"PSEUDOCHROMIDS"
Operculum.....	joined to the skull by a membrane above	joined to the skull by a membrane above	free from the skull above
Maxillary.....	large, with a supramaxillary	large, with a supramaxillary	moderate to small, with or without a supramaxillary
Teeth.....	in bands, many depressible	in bands, many depressible	usually rigid and in one row on the lower jaw posteriorly
Nasal organ.....	in <i>Grammistes</i> , of numerous lamellae	of numerous lamellae	small, with few lamellae
Opercle.....	with 3 spines	with spines reduced, not visible externally	without spines
Preopercle.....	usually with 1 to 4 spines above	with 1 specialized spine above	without spines
Branchiostegal rays.....	6 or 7	7	6
Opercular scales.....	small, similar to those on body	small, similar to those on body	somewhat to greatly enlarged
Body scales.....	embedded, in <i>Grammistes</i> with concentric rings	about as in <i>Epinephelus</i>	about as in <i>Epinephelus</i>
Lateral line.....	single, complete	incomplete or interrupted	incomplete or interrupted
Dorsal and anal spines.....	when present, the last shorter than the penultimate	the last shorter than the penultimate	when present, the last longer than the penultimate
Dorsal and anal soft rays.....	basally embedded in fatty tissue in adult <i>Rypticus</i> and <i>Grammistes</i>	basally embedded in fatty tissue in adult	not embedded in fatty tissue in adult
Inner pelvic ray.....	attached to abdomen by a membrane	attached to abdomen by a membrane	entirely free from abdomen
Pyloric caeca.....	1 or 2	1 or 2	none

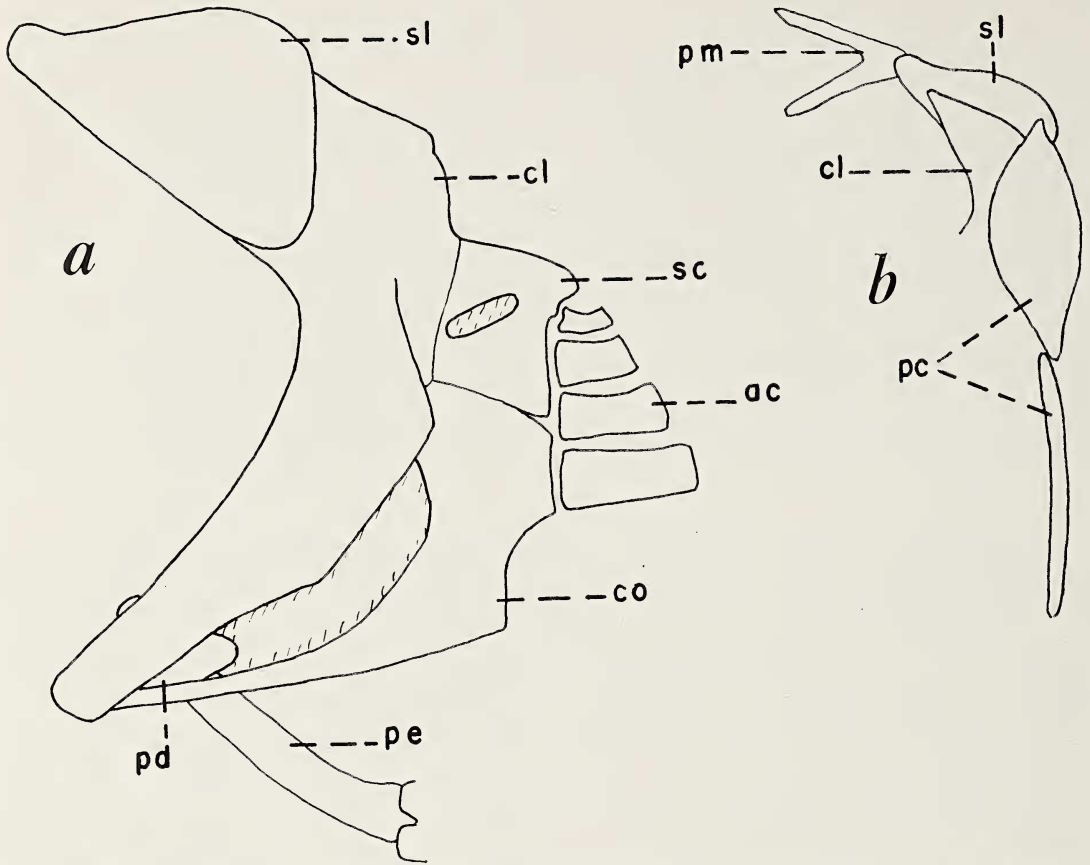


FIG. 7. *Pseudogramma*. *a*, Lower portion of left pectoral and pelvic girdles, from outside; *b*, upper and inner portions of right pectoral girdle, from inside and drawn to about half the scale of *a*. ac, Actinost; cl, cleithrum; co, coracoid; pc, postcleithra; pd, pad on cleithrum for articulation with pelvic girdle; pe, pelvic girdle; pm, posttemporal; sc, scapula; sl, supracleithrum.

nearly parallel, longitudinally oriented lamellae (instead of the usual rosette). Mouth large; supramaxillary present. Teeth mostly villiform, many of them depressible. No enlarged scales on operculum. Upper portion of preopercular border usually with one to four projecting spines. Two (or one) pyloric caeca. Dorsal spines II to VIII. Anal with no or with III spines, in the latter instance with the last spine shorter than the penultimate. Pelvics I, 5, the inner ray attached to the abdomen by a membrane.

The group of genera defined above seems to be sufficiently distinctive to warrant family recognition. That they are all interrelated is indicated by the rather large number of presumably independent minor characters held in common. That they deserve family rather than

subfamily status is a more open question, and the author admits to considerable vacillation on this matter.

The major points in favor of family recognition would seem to be the following: (1) The genera here attributed to the Grammistidae appear to be easily and clearly distinguishable from all other percoid fishes. If intermediates exist between them and other families, they have escaped the author's notice. Apparently the closest relatives are certain members of the Serranidae, e.g., *Diploprion*, with somewhat elongate nasal organ and membranes between the pelvics and the abdomen. However, in other characters *Diploprion* falls clearly with *Epinephelus* rather than with the grammistids. (2) Although the characters differentiating the

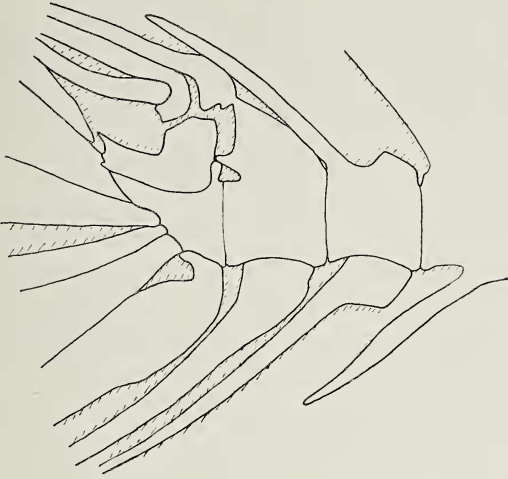


FIG. 8. Caudal skeleton of *Pseudogramma*; intersosseous spaces hatched.

grammistids from related families are morphologically rather trivial, they are no more so than the features distinguishing many percoid families. In the percoids, the only alternative to such a basis of separation would appear to be the lumping of thousands of species into one or a few unwieldy families. (3) The Serranidae is already such a family. Indeed Weber and de Beaufort (1936: 555–559) have found it necessary to separate out the Serranidae at seven different points in their key to the Indo-Australian percoid fishes. Any procedure that would remove one or more of the heterogeneous elements now contained in the Serranidae would make the serranids a more manageable and more meaningful group. (4) The genera here included in the Grammistidae represent a phylogenetic lineage of respectable size. Recognition of the Grammistidae is therefore a somewhat different and, in the author's opinion, a more worthy procedure than chipping off as separate families the most aberrant endpoints of lineages. (5) From a purely practical standpoint, the retention of the grammistids, including the "pseudogrammid" genera, as a subfamily of the Serranidae would make it impossible to use the incomplete or interrupted lateral line as a basis for separating the serranids from the "pseudochromid" groups.

Nevertheless, one very valid argument can be given for retaining subfamily rank for the gram-

mistids: that changes in status of portions of the Serranidae should not be undertaken without a consideration of the family as a whole. The author gladly admits the point. He merely feels that waiting for anything like a comprehensive review of the Serranidae is an impractical procedure.

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